SYLLABUS, Surface Chemistry II, CHM 769

Semester 2, 2018-2019

Instructor: W.T. Tysoe, Room 245, Phone (414) 229-5222

Course: CHM 769, Surface Chemistry II

Prerequisites: Graduate status

Venue: Monday and Wednesday, Room 195, 3:30-4:45 p.m.

Grading: The course will be graded on a final examinations which will be a take-home examination. A score will be assigned on the basis of the results in this examination and the final grade will be made on this basis. The class is *not* graded on a curve.

Department Polices: Please see attached. Further information will be posted on bulletin boards which are (a) across from Room 195 of (b) adjacent to Room 164

Textbook: None

Course Outline: A. Theoretical Aspects

Background - physisorption, chemisorption

Electronic structure of solids
- molecular orbital theory
- free-electron gas

Creation of a Surface
- surface states

Chemisorption on a metal surface
- periodic trends in heat of chemisorption
- CO and NO on transition metal surfaces
- molecular adsorption
- the effect of surface structure
- the ligand field theory of surface bonding
- potential energy curves for adatoms on surfaces

Adsorption kinetics
- the Langmuir model
- precursor state adsorption

- BET isotherm

Statistical Mechanics of adsorption
- the adsorption isotherm
- localized adsorption; the lattice gas
- dependent systems; adatom-adatom interactions
- phase transitions; the Bragg-Williams approximation

Kinetics processes at solid surfaces
- transition state theory
- desorption from a surface
- measurement of kinetics processes; temperature-programmed desorption, molecular beam reactive scattering
- reaction kinetics

B. Experimental Results and Methods

Static surface measurements
- work function
- measurements of adsorbate coverage
- photoelectron spectroscopy; XPS, UPS
- angular variations in photoemission
- thigh-resolution electron energy loss spectroscopy
- Synchrotron radiation studies

Chemisorption on transition metal surfaces
- hydrogen
- carbon monoxide
- halogens
- nitrogen
- hydrocarbons

Mechanistic studies of catalysis
- CO hydrogenation
- ethylene hydrogenation
- selective oxidation of ethylene
- ammonia synthesis